MYCOTAXON

Volume 108, pp. 83–92 *April–June 2009*

New combinations and new species in the lichen genera *Hemithecium* and *Pallidogramme*

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Abstract—Eight species in the lichen genera *Hemithecium* and *Pallidogramme*, including three new species *Hemithecium microspermum*, *Pallidogramme indica,* and *P. undulatolirellata* and five new combinations *Hemithecium epixanthum, H. multistriatum H. salacinilabiatum, H. stictilabiatum*, and *Pallidogramme commutabilis* have been recognized.

Keywords—*Graphidaceae*, taxonomy, ascomycetes, Maharashtra, India

Introduction

In her recent treatment of the lichen family *Graphidaceae,* Staiger (2002) reintroduced the genus *Hemithecium* Trevis. and reported nine species in this genus. Subsequently, 24 species have been added to *Hemithecium*, including 12 species from the Indian subcontinent (Archer 2006, Adawadkar & Makhija 2005, Makhija & Adawadkar 2005, Makhija et al. 2005, Nakanishi et al. 2003).

The occurrence of ten *Hemithecium* species has been confirmed in the lichen flora of Maharashtra state of India. Five species belonging to *Hemithecium* with hyaline, trans-septate ascospores have already been recorded in a recent publication (Makhija et al. 2005). In the present paper the remaining five species of this genus from Maharashtra are recorded including one species new to science and four new combinations.

In addition, three species in *Pallidogramme* Staiger et al., a genus that was recently introduced to accommodate the species in *Hemithecium* subgenus *Leucogramma* Staiger (Lücking et al. 2008), have also been recorded from Maharashtra and are described below.

Material and methods

Chemical constituents were identified by thin-layer chromatography using methods standardized for lichen products (Culberson & Kristinsson 1970,

Culberson 1972, White & James 1985) with the solvent systems benzene-dioxane-acetic acid (180:45:5), hexane-ethyl ether-formic acid (130:80:20) and toluene-ethyl acetate-formic acid (139:83:8). All specimens examined are deposited in Ajrekar Mycological Herbarium (AMH).

Key to the species

1a. Ascospores brown ..... (*Pallidogramme*) **2**

1b. Ascospores hyaline ..... (*Hemithecium*) **4**

2a. Ascospores muriform (ascomata aggregated in patches, 5–7 mm long, branched; exciple non-striate, uncarbonised or slightly carbonised at the tips; ascospores 66–126×21–30 µm; no lichen substances present) ..... ***P. commutabilis***

2b. Ascospores trans-septate **3**

3a. Ascomata wavy, simple to sometimes branched, short, 0.5–6 mm long; disc whitish; exciple with 2–4 indistinct striae, slightly carbonised at the tips; asci 4–8-spored; ascospores brown, 9–13–trans-septate, 25–49×5–9 µm; norstictic, stictic and constictic acids present ..... ***P. undulatolirellata***

3b. Ascomata branched, 1–13 mm long; disc epruinose, exciple brownish, non–striate; asci 2–8-spored; ascospores brown, 13–20–trans-septate, 46–81×7–11 µm; stictic acid and constictic (trace) acids present ..... ***P. indica***

4a. Ascospores muriform, exceeding 100 µm in length **5**

4b. Ascospores muriform, not exceeding 100 µm in length **7**

5a. Lichen substances absent (ascomata distinctly emergent, simple, rarely branched, tri-radiate, 1–7 mm long and 0.2–0.5 mm wide; disc whitish; exciple pale woody brown to dull cream coloured, 4–5 striate; asci 1–2-spored; ascospores ellipsoid to fusiform 150–200×60–75 µm) ..... ***H. multistriatum***

5b. Lichen substances present **6**

6a. Ascomata emergent, 1–9 mm long; proper exciple uncarbonised, 4–5 striate; ascospores 130–200×35–60 µm; salazinic acid present .... ***H. salacinilabiatum***

6b. Ascomata emergent, 1–10 mm long; proper exciple, uncarbonised, striate; ascospores 112–209×30–66 µm; stictic acid present ..... ***H. stictilabiatum***

7a. Ascomata 1–7.5 mm long and 0.1–0.2 mm wide, mostly simple to irregularly branched, flexuous; exciple convergent, non-striate or with 1–2 apical grooves; ascospores 17–21×8–14 µm; constictic, stictic, hyposalazinic and norstictic acids present ..... ***H. microspermum***

7b. Ascomata 2–6 mm long and 0.1–0.2 mm wide, sparsely branched; exciple 3–5 striate, pale yellow to brown, uncarbonised, slightly carbonised only at the tips; ascospores 50–71×15–25 µm; stictic and constictic acids present ..... ***H. epixanthum***

Hemithecium epixanthum (Mont. & Bosch) Chitale & Makhija, **comb. nov.**

MycoBank MB 512865 Figure 1

≡ *Graphis epixantha* Mont. & Bosch, Plant. Junghuhn, Fasc. 4: 472 (1855).

Thallus corticolous, crustose, smooth to cracked, olivaceous buff to citrine green, surrounded by a thin, black hypothallus. Ascomata lirelline, 2–6 mm long and 0.1–0.2 mm wide, simple to sparsely branched, immersed to semi-emergent, straight to curved, wavy, flexuous, concolorous with the thallus, with obtuse ends; thalline margin entire, raised, studded with crystals, encircling the exciple. Disc narrow, reddish brown. Proper exciple 3–5 striate, pale yellow to brown, slightly carbonised only at the tips, present at the base, converging at the apical portion, covered by a thick thalline margin up to the top; hymenium hyaline, not inspersed, 60–80 µm tall, I–, KI–; hypothecium hyaline, 12–17 µm thick; paraphyses simple; asci 8-spored. Ascospores hyaline, muriform, ovoid, oblong, 50–71×15–25 µm, I+ blue–violet.

Chemistry—Stictic and constictic acids present.

Additional specimens examined—Maharashtra, Ahmednagar District, Bhandardara, *G.S. Chitale & B.A. Adawadkar*, 02.162. Kolhapur District, Panhala, *P.G. Patwardhan & A.V. Prabhu*, 74.1051, 74.1070, 74.1077, 74.1081, 74.1088, 74.1093, 74.1109, 74.1112, 74.1114, 74.1117, 74.1125a, 74.1128, 74.1130; *U.V. Makhija & K.R Randive*, 00.380; Vishalgad, *M.B. Nagarkar & A.V. Prabhu,* 74.2169, 74.2181, 74.2190. Nasik District, Saptashringi Gad, *B.C. Behera & G.S. Chitale,* 02.180, 02.181, 02.182, 02.194. Pune District, Bhimashankar, *U.V. Makhija & B.A. Adawadkar*, 97.15, 97.18, 97.21, 97.23, 97.28; Khandala, Boma hill, *A.V. Prabhu, C.R. Kulkarni & M.B. Nagarkar*, 74.627, 74.628, 74.629; Lonavala, Walwan Dam, *B.C. Behera & B.A. Adawadkar*, 02.120; Purandar, *U.V. Makhija & A.V. Bhosale*, 02.54, 02.56, 02.57; Sinhagad, 16.8.2000, *U.V. Makhija & B.A. Adawadkar*, 00.48; Malshej Ghat, Neemgiri, 9.9.2002, *U.V. Makhija & A.V. Bhosale*, 02.12, 02.13, 02.15, 02.19, 02.23, 02.28. Raigad District, Hirdoshi, Bhor-Mahad road, *C.R. Kulkarni*, 74.1957, 74.1967, 74.1980. Ratnagari District, Chiplun, *G.S. Chitale;* Dabhole Ghat, *A.V. Prabhu & M.B. Nagarkar*, 74.2091; Gagan Bavda, *C.R. Kulkarni & A.V. Prabhu*, 74.1667. Sindhudurg District, Amboli, *C.R. Kulkarni & A.V. Prabhu,* 74.1385, 74.1389, 74.1391, 74.1416, 74.1421, 74.1422, 74.1433, 74.1437, 74.1438, 74.1441, 74.1442, 74.1485, 74.1555, 74.2280, 74.2281, 74.2290, 74.2319, 74.2362; *U.V. Makhija & K.R. Randive*, 00.211, 00.226, 00.272; Kasal, *U.V. Makhija & K.R. Randive,* 00.279, 00.244 -AMH.

Remarks—*Hemithecium epixanthum* exhibits a great variation in colour of the thallus, ascomata, and branching pattern but shows uniform internal morphology and chemistry in having stictic and constictic acids. This species was previously reported as *Graphina epixantha* (Mont. & Bosch) Zahlbr. (Patwardhan & Kulkarni 1976) from the western ghats of south India.

The species is found on the bark of the roadside trees in dry deciduous and semi-evergreen forests.

Hemithecium microspermum Chitale, Makhija, B.O. Sharma, **sp. nov.** Figure 2
MycoBank MB 512864

Species insignis ascosporis minoribus, muiformis, 17–21 x 8–14 µm; acida constictícum, norstictícum, stictícum et hyposalazinicum continens.

Etymology: From the latin word *micro*, small, and *spermum*, seed, a reference to small ascospores.

Holotypus—India, Maharashtra, Kolhapur District, Vishalgad, 6.12.1974, *C.R. Kulkarni & P.G. Patwardhan,* 74.2234:AMH.

Thallus corticolous, crustose, greenish–gray, smooth, cracked with the age, delimited by a black hypothalloidal region at the periphery. Ascomata lirelline, semi-immersed, mostly simple to irregularly branched, flexuous, 1–7.5 mm long and 0.1–0.2 mm wide. Disc narrow, slit like, epruinose. Proper exciple concolorous with the thallus, convergent, entire or with 1–2 apical groves, uncarbonised. Hymenium hyaline, 63–80 µm tall, not inspersed; hypothecium hyaline, 17–21 µm thick; paraphyses simple; asci 6–8-spored. Ascospores hyaline, muriform, 5–6–trans-septate, 4–5 vertical septa, ellipsoidal, oblong, 17–21×8–14 µm, without halo, I+ violet.

Chemistry—Constictic, hyposalazinic, norstictic and stictic acids present.

Additional specimens examined—Maharashtra, Sindhudurg District, Amboli, *A.V. Prabhu & M.B. Nagarkar,* 74.2307-AMH

Remarks—The new species *Hemithecium microspermum* is characterised by 1–7.5 mm long ascomata, uncarbonised exciple and hyaline, muriform, small ascospores of 17–21 × 8–14 µm in size and by the presence of constictic, hyposalazinic, norstictic and stictic acids in its thallus and thus stands distinct, amongst all the known species of this genus. The species has been collected in montane forest at higher elevation.

Externally *H. microspermum* is somewhat similar with *Fissurina rufula* (Mont.) Staiger, however *F. rufula* have 4–locular, hyaline ascospores.

Hemithecium multistriatum (Müll. Arg.) Chitale & Makhija, **comb. nov**. Figure 3
MycoBank MB 512866

≡ *Graphina multistriata* Müll. Arg., J. Linn. Soc., Bot. 29: 227 (1892).

Holotypus—India, Manipur, G. Watt, No. 85, Isotype – G (!).

Thallus corticolous, crustose, pale citrine to amber green, continuous, smooth; hypothallus distinctly black. Ascomata lirelline, distinctly emergent, pale woody brown to dull, cream coloured, straight to curved, flexuous, simple to rarely branched, tri-radiate, 1–7 mm long and 0.2–0.5 mm wide. Disc narrow slit like to open, pale. Proper exciple pale woody brown, to dull cream coloured,

Figures 1–8. Habit. 1. *Hemithecium epixanthum.* 2. *H. microspermum* (Holotype). 3. *H. multistriatum.* 4. *H. salacinilabiatum.* 5. *H. stictilabiatum.* 6. *Pallidogramme commutabilis.* 7. *P. indica* (Holotype). 8. *P. undulatolirellata* (Holotype). Bar = 1 mm

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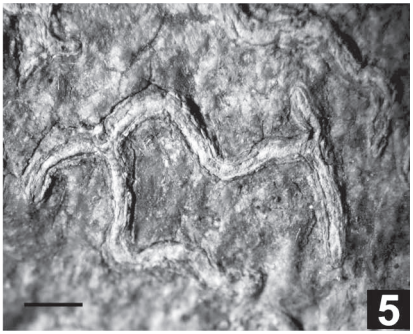
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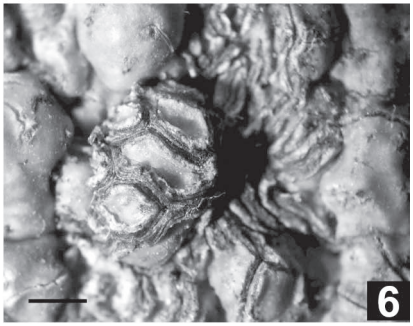
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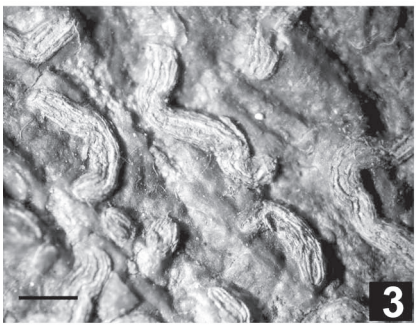
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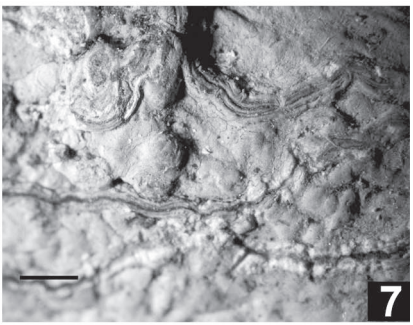
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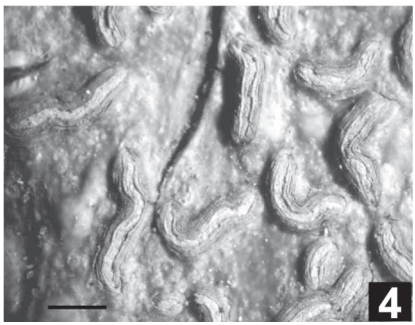
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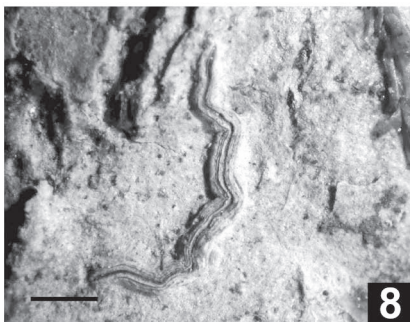
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distinctly 4–5 striate, completely uncarbonised, present at the base. Hymenium hyaline, 150–250 µm tall, not inspersed; hypothecium hyaline, 13–20 µm thick; paraphyses simple, long slender; asci 1–2-spored. Ascospores hyaline, muriform, ellipsoid to fusiform, 150–200×60–75 µm, I+ violet.

Chemistry—No lichen substances present.

Additional specimens examined—Maharashtra, Sindhudurg District, Amboli to Sawantawadi, Road, Nanapali, *C. R. Kulkarni*, 74.2313, 74.2358-AMH.

Remarks—*Hemithecium multistriatum*, described by Müller (1892) from Manipur of India, can easily be distinguished by its conspicuous ascomata with emergent, pale woody brown, well developed multi-striate exciple, colourless, muriform, larger ascospores and no lichen substances in its thallus.

Pallidogramme chrysenteron (Mont.) Staiger et al., a species externally similar to *Hemithecium multistriatum* and the other two species of *Pallidogramme* namely *P. chlorocarpoides* (Nyl.) Staiger et al. and *P. chapadana* (Redinger) Staiger et al., differs from the present species in having brown, muriform ascospores and lichen substances.

Although Patwardhan & Kulkarni (1979b), while describing three new species of *Graphina multistriata* complex (i.e., *G. norlabiata, G. salacinilabiata, G. stictilabiata*) did not formally record the occurrence of *G. multistriata* from the western ghats of south India, they did include three photographs (Patwardhan & Kulkarni 1979b: plate 1, Fig. 1–3) of this species from Karnataka (AMH-74.3003), Kerala (AMH-76.355) and Maharashtra (AMH-74.2313).

Hemithecium multistriatum appears to be endemic to India where it is found on tree trunks in semi-evergreen and dry deciduous forests.

Hemithecium salacinilabiatum (Patw. & C.R. Kulk.) Chitale & Makhija, **comb. nov.** Figure 4

MycoBank MB 512867

≡ *Graphina salacinilabiata* Patw. & C.R. Kulk., Biovigyanam 5: 6 (1979).

Holotypus—India, Karnataka, Coorg, Talcauvary, *M.B. Nagarkar & A.V. Prabhu* 74.3333:AMH (!.)

Thallus corticolous, crustose, pale green to brownish green, continuous, smooth to unevenly thickened; hypothallus black. Ascomata lirelline, distinctly emergent, pale woody brown to dull cream coloured, straight to curved, flexuous, simple to rarely sparsely branched, 1–9 mm long and 0.2–0.5 mm wide. Disc narrow to open, cream coloured. Proper exciple woody brown, 4–5-striate, uncarbonised, present at the base. Hymenium hyaline, 150–220 µm tall, not inspersed; hypothecium hyaline, 12–21 µm thick; paraphyses simple; asci 1–2-spored. Ascospores hyaline, muriform, 130–200×35–60 µm, I+ violet.

Chemistry—Salazinic acid present.

Additional specimens examined—Maharashtra, Sindhudurg District, Amboli, *A. V. Prabhu & M. B. Nagarkar*, 74.2259.74.2358-AMH.

Remarks—*Hemithecium salacinilabiatum* can easily be distinguished from the closely related species *H. multistriatum* in having salazinic acid in its thallus. *H. multistriatum* has no lichen substances.

Hemithecium salacinilabiatum was described by Patwardhan & Kulkarni (1979b) as *Graphina salacinilabiata* from the western ghats of south India.

This species occurs in moist deciduous forests at an elev. 690 m.

Hemithecium stictilabiatum (Patw. & C.R. Kulk.) Chitale & Makhija, **comb. nov.**
MycoBank MB 512868 Figure 5

≡ *Graphina stictilabiata* Patw. & C.R. Kulk., Biovigyanam 5: 7 (1979).

Holotypus—India, Karnataka, South Canara, Rippon Peth–Tirthahalli road, *C.R. Kulkarni*. 74.2875:AMH (!).

Thallus corticolous, crustose, olivaceous green, continuous, smooth; hypothallus black. Ascomata lirelline, distinctly emergent, pale woody brown to dull, cream coloured, straight to curved, flexuous, simple to rarely with short branches, 1–10 mm long and 0.2–0.7 mm wide. Disc narrow slit-like to open, pale white. Proper exciple pale woody brown, 4–5 striate, completely uncarbonised, present at the base. Hymenium hyaline, 150–210 µm tall, not inspersed; hypothecium hyaline, 13–17 µm thick; paraphyses simple; asci 1–2-spored. Ascospores hyaline, muriform, 112–209×30–66 µm, I+ violet.

Chemistry—Stictic acid present.

Additional specimens examined—Maharashtra, Kolhapur District, Vishalgad, on the way from Amba to Gajapur, *C.R. Kulkarni & A.V. Prabhu*, 74.2196. Sindhudurg District, Amboli, *P.G. Patwardhan & M.B. Nagarkar*, 74.2258, 74.2310-AMH.

Remarks— Patwardhan & Kulkarni (1979b) described this species as *Graphina stictilabiata,* who also reported it from Maharashtra. *Hemithecium stictilabiatum* differs from the most closely related *H. multistriatum* (which lacks lichen substances) in having stictic acid in its thallus. The species has been collected in semi-evergreen forests.

Pallidogramme commutabilis (Kremp.) Chitale & Makhija, **comb. nov.**
MycoBank MB 512873 Figure 6

≡ *Graphis commutabilis* Kremp.,Nuov. Giorn. Bot. Ital. 7: 33 (1875).

Thallus corticolous, crustose, light orange yellow to yellowish brown, strongly warty, cracked, studded with crystals, thick, with a corticiform layer. Ascomata lirelline, concolourous with the thallus, immersed to semi-emergent, more or less aggregated in defused patches on the thallus, flexuous, 5–7 mm long, branched, rarely simple, terminally obtuse; thalline margin distinctly raised, concolorous with the thallus. Disc narrow slit-like. Proper exciple entire, non-striate, convergent, pale brown, uncarbonised or slightly carbonised at the tips. Hymenium hyaline, 90–126 µm tall, not inspersed, I–, KI–; hypothecium hyaline, 16–21 µm thick; paraphyses simple. Asci 4–8-spored. Ascospores

brown, muriform, ellipsoidal, with many transverse and vertical septa, 66–126 ×21–30 µm, I–.

Chemistry—No lichen substances present.

Additional specimens examined—Maharashtra, Satara District, Mahabaleshwar, Wilson point, *M.B. Nagarkar & A.V. Prabhu,* 73.2931-AMH.

Remarks—*Pallidogramme commutabilis*, a species originally described from Borneo, appears to be rather rare and is known in India from a single collection from Mahabaleshwar in Maharashtra, where it was found on the bark of a tree in semi-evergreen forest at an altitude of about 1400 m. This species was earlier reported as *Phaeographina commutabilis* (Kremp.) Zahlbr. by Patwardhan & Kulkarni (1979a).

Pallidogramme indica A. Dube & Makhija, **sp. nov.** Figure 7

MycoBank MB 512571

Similis Pallidogramme undulatolirellata*, sed lirellis longioribus (1–13 mm); excipulo non crenulato; ascosporis majoribus, 13–20-trans-septatis; et acida constictum, sticticum continens differt.*

Etymology: From the country name India.

Holotypus—India, Maharashtra, Sindhudurg District, Amboli, 18.10.1974, *C.R. Kulkarni & A.V. Prabhu,* 74.1434:AMH.

Thallus corticolous, crustose, glaucous, yellowish–brown, epiphloeodal, smooth to rough, cracked with the age. Ascomata lirelline, concolorous with the thallus, flexuous, dendroidally branched, semi–emergent, terminally acute, 1–13 mm long and 0.3–0.7 mm wide. Disc narrow, slit like. Proper exciple brownish, entire, present at the base, uncarbonised, convergent. Hymenium hyaline, not inspersed, 77–140 µm tall, KI–; hypothecium hyaline, 18–35 µm thick; paraphyses simple; asci 2–8-spored. Ascospores hyaline to brown, fusiform–oblong, 13–20-trans-septate, 46–81×7–11 µm.

Chemistry—Stictic and constictic (trace) acids present.

Remarks—*Pallidogramme indica* is somewhat similar to the new species *P. undulatolirellata* (below) in appearance and in having brown ascospores but the two species are easily differentiated in the size of the ascomata, ascospores, and chemistry. *Pallidogramme undulatolirellata* has short (0.5–6 mm long), wavy lirellae, ascospores of 25–49×5–9 µm and a thallus with constictic, stictic, and norstictic acids whereas *P. indica* has longer lirellae (1–13 mm long), larger (46–81×7–11 µm) ascospores and a thallus with constictic (trace) and stictic acids.

Pallidogramme indica was collected at an altitude of 690 m in montane subtropical forests.

Pallidogramme undulatolirellata A. Dube & Makhija, **sp. nov.** Figure 8

MycoBank MB 512872

Similis Pallidogramme indica*, sed lirellis undulatus, brevioribus (0.5–6 mm); excipulo crenulato; ascosporis minoribus, 9–13 trans-septatis; et acida consticticum, sticticum et norsticticum continens differt.*

Etymology: From the latin *undulatus*, wavy; *lirellatus*, lirellae or linear apothecia; a reference to nature of wavy lirellae.

Holotypus—India, Maharashtra, Kolhapur District, Panhala, 13.10.2000, *U.V. Makhija & K.R. Randive*, 00.392:AMH.

Thallus corticolous, crustose, buff to glaucous green, smooth, cracked with the age, delimited by a black hypothallus. Ascomata lirelline, concolorous with the thallus, short, highly wavy and curved, simple to sometimes dendroidally branched, semi-emergent to emergent, terminally acute, 0.5–6 mm long and 0.2–0.5 mm wide; thalline margin paler than the thallus. Disc narrow, dark reddish brown, 0.1–0.2 mm wide. Proper exciple reddish brown to blackish brown, 2–4 striate, present at the base, convergent, uncarbonised, sometimes blackish brown at the tips, covered by a thick thalline margin up to the top. Hymenium hyaline, not inspersed, 70–88 µm tall, I–, KI–; hypothecium hyaline, 14–18 µm thick; paraphyses simple; asci 4–8-spored. Ascospores brown, fusiform–oblong, 9–13-trans-septate, 25–49×5–9 µm, I–.

Chemistry—Norstictic, stictic and constictic acids present.

Additional specimens examined—Maharashtra, Kolhapur District, Amba, *C.R. Kulkarni & A.V. Prabhu*, 74.1255, 74.1263; *M.B. Nagarkar & A.V. Prabhu*, 74.2224. Sindhudurg District, Amboli, *C.R. Kulkarni & A.V. Prabhu*, 74.1408, 74.1411, 74.1651; Gaganbavda, *C.R. Kulkarni & A.V. Prabhu*, 74.1658, 74.1659, 74.1661-AMH.

Remarks—In the present studies only two *Pallidogramme* species have been found with brown trans-septate ascospores. The new species, *P. undulatolirellata* resembles the new species *P. indica* (above) in having simple to dendroidally branched ascomata and convergent exciple but differs in chemistry and lirellae and ascospore sizes. *Pallidogramme undulatolirellata* has short, wavy lirellae (0.5–6 mm long), ascospores 9–13 trans-septate measuring 25–49×5–9 µm, and constictic, norstictic and stictic acids, whereas *P. indica* has larger (1–13 mm long) lirellae, ascospores 13–20–trans-septate measuring 46–81×7–11 µm, and constictic (trace) and stictic acids.

The specimens were collected in rain forests.

Acknowledgements

We would like to thank Dr. A.W. Archer and Dr. Robert Lücking for their valuable suggestions. We are grateful to the Ministry of Environment and Forest, and the Department of Science and Technology, Govt. of India, New Delhi for the financial support.

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